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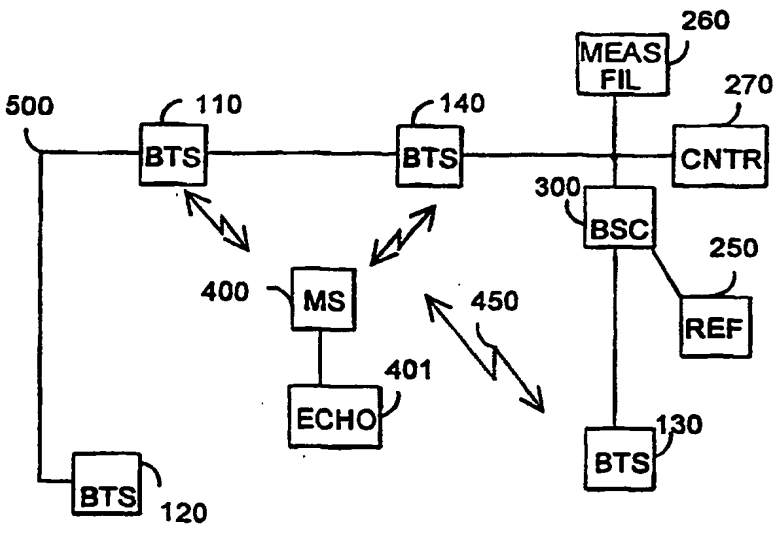

(57) Abstract

The invention relates to a data transmission method and a radio system comprising a number of transceivers (110, 120, 130, 140) and at least one subscriber terminal (400) which transmits a number of access bursts on its traffic channel during handover. In the radio system, a connection between a transceiver and a subscriber terminal is set up when the transceiver receives from its random access channel an access burst transmitted by the subscriber terminal (400), the reception of said access burst activating the allocation of a channel used for the connection. The radio system comprises means (260) for measuring the bursts received by the transceiver from the random access channel, means (250) for generating a handover reference signal which deviates from the bit pattern of the random access burst and which is transmitted to the treansceiver during handover, whereupon it is possible for the means (260) to filter off the handover reference signal received in order to prevent the allocation of a channel.

DATA TRANSMISSION METHOD AND RADIO SYSTEM

FIELD OF THE INVENTION

The invention relates to a data transmission method to be used during handover in a radio system comprising a number of transceivers and at least one subscriber terminal which transmits a number of access bursts on its traffic channel during handover, and in which radio system a connection between a transceiver and a subscriber terminal is set up when the transceiver receives from its random access channel an access burst transmitted by the subscriber terminal, the reception of said access burst activating the allocation of a channel to be used for the connection.

The invention further relates to a radio system comprising a number of transceivers and at least one subscriber terminal which transmits a number of access bursts on its traffic channel during handover, and in which radio system a connection between a transceiver and a subscriber terminal is set up when the transceiver receives from its random access channel an access burst transmitted by the subscriber terminal, the reception of said access burst activating the allocation of a channel to be used for the connection.

DESCRIPTION OF THE PRIOR ART

A special random access channel (RACH) is used in radio systems for setting up a connection between a terminal and a base station. When the terminals desire to set up a radio connection, they send a message of setting up the connection, in other words a random access burst, to the base station which forwards it to the system in which resources are allocated for the connection. This means that a particular time slot which enables the connection setup message to be sent by the terminals to the base station is allocated for the message. The system can by no means know when the terminals desire to communicate, so the first message of the terminal to the base station can not be coordinated. The terminals also lack information about the length of the propagation delay of the signal, thus the messages are randomly supplied within a given time slot.

In a typical cellular radio system, the subscriber terminal communicates with only one base station at a time, although particularly in the CDMA system, for example, the subscriber terminal can also communicate with several base stations simultaneously. When the terminal moves in the area of the

base station which is not involved in the handover. The unnecessary channel allocations reduce the capacity available for the radio system.

Insufficient network planning is the main reason why a base station receives a signal which is not originally intended to the base station. In practice, however, it is not possible to plan a radio network in such a manner that all the above problems could be eliminated. It is increasingly difficult to take account of said problems in advance in network planning, since network planning is constantly becoming more complex. In practice, it is not possible to prevent all unnecessary channel allocations by means of network planning.

FI 100077 B discloses a mobile communication system in which a mobile station and a base station measure the power of a received signal, whereupon it is possible for the base station to use the measurement results to decide whether to change base stations. This publication does not, however, disclose any criterion by which it would be possible to perform a filtering. The described solution is, however, used for deciding whether to change base stations and not for preventing channel allocation.

EP 0615392 A1 discloses a method in which the parameters located in a signal transmitted between a base station and a mobile station are measured. The measurement results obtained can be used to decide whether to change base stations. The solution disclosed in the publication is not, however, suitable for filtering unnecessary channel allocation requests.

DE 19510256 A1 discloses a method in which the parameters located in a signal transmitted between a base station and a mobile station are measured and the values of the parameters are compared with threshold values. The method seems to be suitable for deciding whether to change base stations and not for filtering channel allocation requests.

WO 97/15169 discloses a method in which the time slots of the received signals are measured. The measurement results are, however, used to decide whether to change base stations and not for filtering channel allocation requests.

WO 95/22876 discloses a method in which time slots are measured and in which some parameters are picked from the measurement results obtained. The method is, however, used in handover and not for filtering channel allocation requests.

FI 934731, GB 2280335 A, GB 296628 A and WO 96/166524 A3 each discloses a method in which time slots are measured and in which some

Figure 1 shows a radio system in which the method of the invention is used

Figure 2 is a signal flow diagram of a connection setup,

Figure 3 shows an access burst,

Figure 4 is a signal flow diagram of a handover,

Figure 5 shows the radio system of the invention in closer detail.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 shows a radio system in which the method of the invention is used. The radio system comprises base stations 110, 120, 130, 140 operating as transceivers, a base station controller 300, and at least one subscriber terminal 400. The base station controller 300 and the base stations are interconnected by a digital transmission link 500 in the solution of the figure. The base station controller 300 controls the operation of the base stations 110, 120, 130, 140.

When the subscriber terminal 400 moves from the coverage area of a base station to the coverage area of another base station, a handover is performed. The subscriber terminal 400 sets up a connection to the base station utilizing a traffic channel (TCH). In practice, one time slot forms a TCH channel.

Figure 1 shows a dotted line 10 to describe the boundary region between the base stations 110 and 140. The boundary region separates the coverage areas of the base stations from each other. At point 1 the subscriber terminal 400 communicates with the base station 110. When the subscriber terminal 400 moves on in the base station network, it arrives at point 2 where it is on the edge of the coverage areas of the base stations 110 and 140. In such a case, a handover is performed to the subscriber terminal 400, which means that the base station 110 is changed to the base station 140. At point 3 the subscriber terminal communicates only with the base station 140.

Figure 2 is a signal flow diagram of a process of setting up a connection to a base station by a subscriber terminal. The set-up connection is used, for example, for transmitting speech to another subscriber terminal. Let us assume, with reference to Figure 1, that the subscriber terminal 400 is located at point 1. Let us further assume that point 1 is located within the coverage area of the base station 110. The setup of a connection is initiated in such a manner that the subscriber terminal 400 transmits an access burst to a radio

base station. After the handover the subscriber terminal 400 transmits an acknowledgement of the successful handover to the base station controller 300, the acknowledgement passing via the base station 140. The subscriber terminal 400 and the base station 140 use the traffic channel (TCH) in the above situation when they transmit the signals associated with the handover.

Figure 5 shows the structure of the radio system of the invention in closer detail. The radio system comprises means 401 which are operatively connected to the subscriber terminal 400. In addition, the radio system comprises means 250 which are preferably operatively connected to the base station controller 300. In the radio system of the figure, the base station controller 300 comprises the means 250. Let us assume that the subscriber terminal 400 moves towards point 2 shown in Figure 1, whereby the handover is performed as described above. The handover access bursts transmitted by the subscriber terminal 400 can, however, transfer in accordance with a signal 450 in such a manner that the base station 130 receives the bursts from its RACH channel. In the prior art radio systems, the reception of the access bursts thus causes the allocation of channels from the base station 130.

In the radio system of the figure, the means 250 generate a handover reference signal which is forwarded to the base station 110. The base station controller 300 commands the subscriber terminal 400 to perform the handover, whereupon the base station 110 transmits the handover reference signal generated by the means 250 to the subscriber terminal 400. The means 401 echo the handover reference signal received by the subscriber terminal 400 back to the radio system in the handover access burst. In the data transmission method of the invention, the means 250 select a bit pattern which deviates from the regular bit pattern of the random access burst for the reference signal used in the handover command.

The means 250 use an eight-bit signal which comprises a 01100XXX or a 0111XXXX bit pattern as the handover reference signal. The X-bits are 'don't care bits', in other words they can be given the values '0' or '1'. It is also possible to use rare bit patterns in the radio system as the bit pattern of the reference signal. It is possible to distinguish the handover access bursts and the random access bursts from each other on the basis of the bit pattern. The bit pattern of the reference signal enables the handover access bursts received from the RACH channel to be detected and to be filtered.

the signalling message. The message is sent from the base station controller 300 to a base station which sends the message to the subscriber terminal 400. The message comprises information elements comprising a so-called handover reference value. The subscriber terminal 400 uses the handover reference value located in the signal it received when it transmits handover access bursts in handover.

The method is based on the measurement of the transmission frequency of the random access bursts transmitted by the subscriber terminal 400. The subscriber terminal transmits random access bursts typically on the RACH channel at intervals of a few dozens of frames, for example. Random reference values which are randomly selected are used in the random access bursts. This means that each burst comprises a different random reference value, i.e. parameter.

Dozens of access bursts comprising the same random reference value in successive RACH channel frames are detected in the event of a handover fault. If the base station 130, for example, receives a number of similar access bursts exceeding a predetermined limit from the successive RACH channel frames of the RACH channel, it is thus possible to infer, on the basis of the above, that the subscriber terminal 400 attempts a handover. The method thus enables to detect that the access bursts received from the RACH channel were intended for handover and not for setting up a connection. After detecting the bursts the means 260 filter off the access bursts comprising similar data, whereby the base station is prevented from allocating a channel. The means 260 measure the RACH channel uninterruptedly.

Furthermore, in the method it is possible to use a timing advance parameter in addition to the random reference parameter. The timing advance parameter is used for correcting transit delay on a radio path. The timing advance parameter is used as a transmission advance parameter which describes the distance between the subscriber terminal 400 and the base station. In the radio system of the figure, the means 260 measure the random reference and timing advance parameters from the signal received by the base station, and the signal is filtered on the basis of these parameters. The filtering can also be based on parameters corresponding to the above parameters. The prevention of channel allocation can also be based on the filtering of a handover signal supplied to the RACH channel when the handover signal comprises a handover reference signal.

CLAIMS

1. A data transmission method to be used during handover in a radio system comprising a number of transceivers (110, 120, 130, 140) and at least one subscriber terminal (400) which transmits a number of access bursts on its traffic channel during handover, and in which radio system a connection between a transceiver and a subscriber terminal is set up when the transceiver receives from its random access channel an access burst transmitted by the subscriber terminal (400), the reception of said access burst activating the allocation of a channel to be used for the connection, **characterized** in that

bursts received from the random access channel by the transceiver are measured,

a handover reference signal which deviates from the random access burst is transmitted to the transceiver during handover, and

the received handover reference signal is filtered off on the basis of a measurement, whereby the allocation of a channel can be prevented.

2. A data transmission method as claimed in claim 1, **characterized** in that during handover, the handover reference signal which deviates from the random access burst is transmitted to the transceiver on the traffic channel, and the received handover reference signal is filtered off if the handover reference signal is received from the random access channel.

3. A data transmission method as claimed in claim 1, **characterized** in that the handover reference signal is filtered off when the base station receives the handover reference signal from the random access channel.

4. A data transmission method as claimed in claim 1, **characterized** in that the handover reference signal is transmitted to the subscriber terminal which echoes the handover reference signal received back to the transceiver.

5. A data transmission method as claimed in claim 1, **characterized** in that the handover reference signal whose bit pattern deviates from the access burst used in allocating a channel on the basis of a different bit pattern is used in the handover.

6. A data transmission method as claimed in claim 1, **characterized** in that the handover reference signal which comprises a

13. A radio system as claimed in claim 10, **characterized** in that the means (260) filter off the handover reference signal when the base station receives the handover reference signal from the random access channel.

14. A radio system as claimed in claim 10, **characterized** in that the handover reference signal is first transmitted to the subscriber terminal (400), and the radio system comprises means (401) for echoing the handover reference signal received by the subscriber terminal back to the transceiver.

15. A radio system as claimed in claim 10, **characterized** in that the bit pattern of the handover reference signal generated by the means (250) deviates from the random access burst used in allocating a channel on the basis of a different bit pattern.

16. A radio system as claimed in claim 10, **characterized** in that the handover reference signal generated by the means (250) comprises a 01100XXX or a 0111XXXX bit pattern where the X-bit is a 'don't care bit'.

17. A radio system as claimed in claim 10, **characterized** in that in practice the transceiver in the radio system is a base station.

18. A radio system as claimed in claim 10, **characterized** in that the means (260) measure the random access channel uninterruptedly.

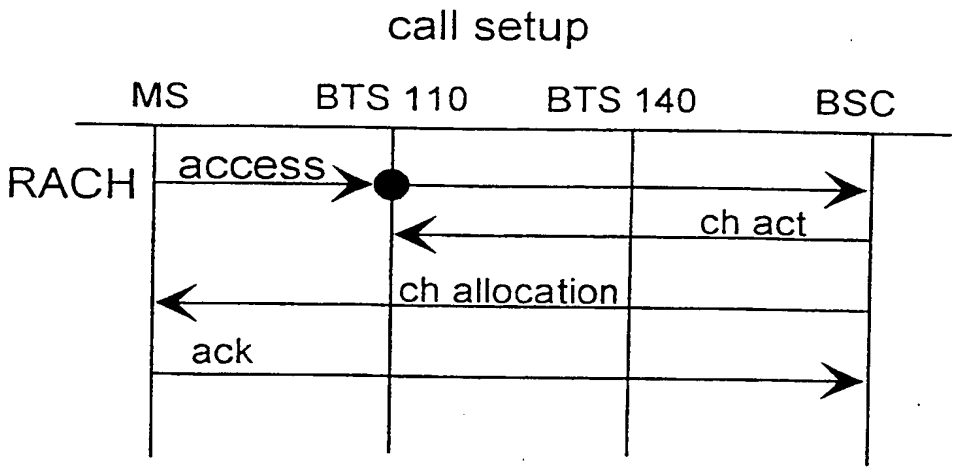

Fig. 2

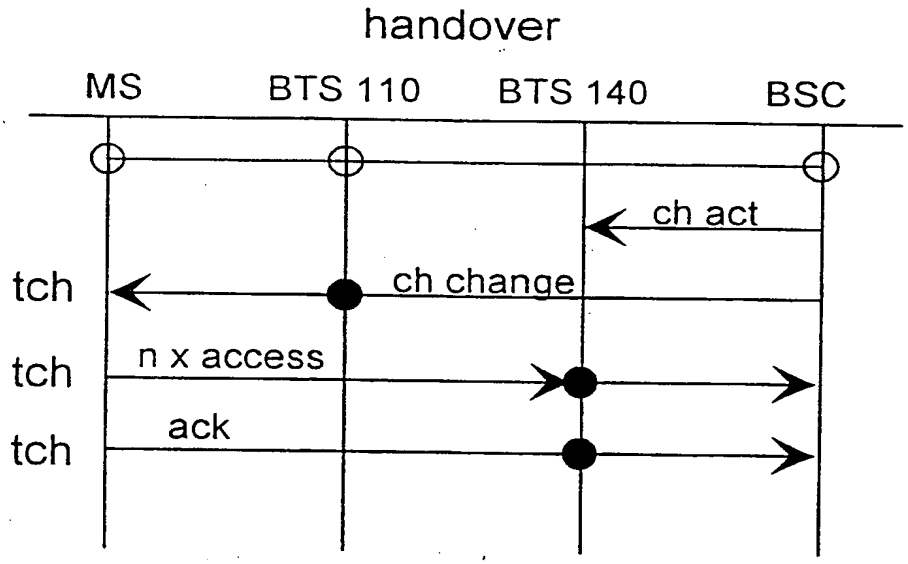

Fig. 4

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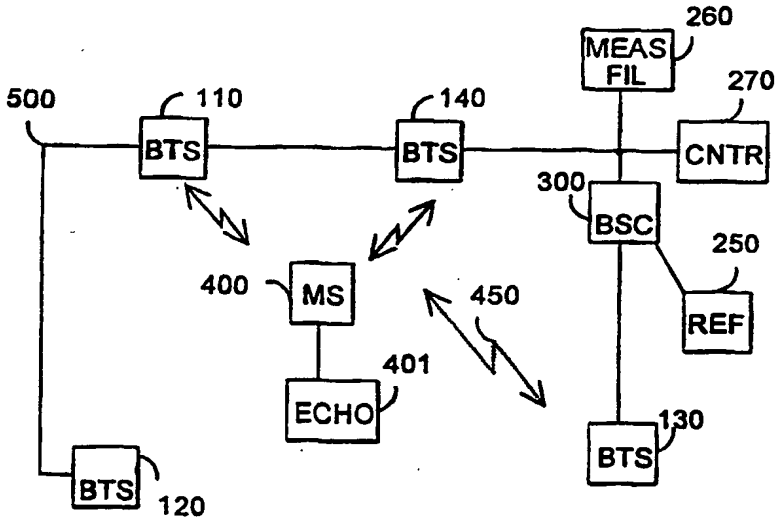

(57) Abstract

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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